UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/750,021	12/30/2003	Tae-Woo Jung	51876P542	9323

8791 7590 05/17/2006

BLAKELY SOKOLOFF TAYLOR & ZAFMAN
12400 WILSHIRE BOULEVARD
SEVENTH FLOOR
LOS ANGELES, CA 90025-1030

EXAMINER	
JEFFERSON, QUOVAUNDA	

ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 05/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/750,021	JUNG ET AL.
	Examiner	Art Unit
	Quovaunda Jefferson	2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *9 March 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6 and 8-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6 and 8-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *various*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment and Arguments

Applicant has amended claims 1, 2, 3, 9, and 14; no new claims have been added. Claims 1-6, and 8-20 are currently pending in this application. As a response to the amended claims and arguments set by the applicant, the examiner is citing new prior art found.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 9, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park et al, US Patent 6,465,866 in view of Yu et al, US Patent 5,801,083.

Regarding claim 1, Park teaches a method for forming a device isolation layer of a semiconductor device, comprising the steps of forming a pad layer pattern **42, 44** defining a device isolation layer on a substrate **40** (Figure 5A), forming a trench **47** by etching an exposed portion of the substrate with use of the pad layer pattern as a mask (Figure 5B), forming a lateral oxide layer **48** on a partial surface of the substrate, the partial surface consisting of sidewalls and a bottom area in the trench **47** by a dry oxidation technique (column 5, lines 61-65), wherein the dry oxidation technique oxidates the sidewalls and a bottom area in the trench formed by the etching process, forming a liner nitride layer **50** on the lateral oxide layer (Figure 5C), forming an insulation layer **52** on the liner nitride layer to fill the trench (Figure 5D), and planarizing the insulation layer (Figure 5D and column 3, lines 22-32).

Park fails to teach performing an etching process to make top corners of the trench rounded by controlling an angle of the top corners of the trench according to a contained quantity of hydrogen bromide and chlorine gas in an etching gas. Yu teaches an etching process to make top corners of the trench rounded by controlling an angle of the top corners of the trench according to a contained quantity of hydrogen bromide and chlorine gas in an etching gas (column 3, lines 36-41). It would have been obvious to one skilled in the art to combine the teachings of Yu with that of Park because the tapered or sloped edge of the trench can be controlled by the etching conditions such as gas ratio, pressure, and bias (Yu, column 1, lines 37-41).

Regarding claim 9, Park teaches a method for fabricating a semiconductor device, comprising the steps of performing an etching process to the trench so that the top corners of the trench become more rounded (column 6, lines 58-65), forming a lateral oxide layer **48** on a partial surface of the substrate **40**, the partial surface consisting of sidewalls and a bottom area of the trench **47** by oxidating sidewalls of the trench and the bottom area in the trench formed by the etching process (Figure 5C, column 5, lines 61-65), forming a liner nitride layer **50** on the lateral oxide layer (Figure 5C), forming an insulation layer **52** on the liner nitride layer to bury the trench (Figure 5D), planarizing the insulation layer until a surface of the substrate is exposed (Figure 5D, column 3, lines 22-32), forming an oxide layer **54** on the exposed surface of the substrate (Figure 5F), and forming a conductive layer **56** for a gate electrode on an entire surface of a structure containing the oxide layer (Figure 5F). Park fails to teach forming a trench of which top corners are rounded by etching a surface of a substrate to a predetermined depth by controlling an angle of the top corners of the trench according to a contained quantity of hydrogen bromide and chlorine gas in an etching gas.

Yu teaches forming a trench of which top corners are rounded by etching a surface of a substrate to a predetermined depth by controlling an angle of the top corners of the trench according to a contained quantity of hydrogen bromide and chlorine gas in an etching gas (column 3, lines 36-41). It would have been obvious to one skilled in the art to combine the teachings of Yu with that of Park because the

tapered or sloped edge of the trench can be controlled by the etching conditions such as gas ratio, pressure, and bias (Yu, column 1, lines 37-41).

Regarding claim 11, Park teaches the method as recited in claim 9, wherein the lateral oxide layer is formed through a dry oxidation technique (column 4, lines 55-59).

Claims 2, 4, 5, 8, 13, 16, 18, and 19 rejected under 35 U.S.C. 103(a) as being unpatentable over Park and Yu as applied to claims 1, 9, and 11 above, and further in view of Ibok, US Paten 6,180,466.

Regarding claim 2, Park and Yu fails to explicitly teach the method as recited in claim 1, wherein an angle of the top corners of the trench is controlled in a range from about 30° to about 60°. Ibok teaches an angle of the top corners of the trench is controlled in a range from about 30° to about 60° (column 4, lines 35-39). It would have been obvious to one skilled in the art to combine the teachings of Ibok with that of Park and Yu because corners with a more oblique corner angle cause less stress (Ibok, column 4, lines 39-41).

Regarding claim 4, Park and Yu fail to teach the method as recited in claim 1, wherein the etching process proceeds by employing an isotropic etching technique. Ibok further teaches the etching process proceeds by employing an isotropic etching technique (abstract). It would have been obvious to one skilled in the art to combine the

teachings of Ibok with that of Park and Yu because the isotropic etch enables the thermal oxidation to form an oxide liner with rounded edges and reduced stress (Ibok, abstract).

Regarding claim 5, Ibok further teaches the method as recited in claim 4, wherein an angle of top corners of the trench ranges from about 50° to about 80° through the use of the isotropic etching technique (column 4, lines 35-39).

Regarding claim 8, Park further teaches the method as recited in claim 1, wherein the dry oxidation technique is performed to form the lateral oxide layer with a thickness ranging from about 60 A to about 100 A (abstract), but fails to teach a dry oxidation technique is performed at a temperature of about 900°C to about 1000°C. Ibok teaches a dry oxidation is performed at a temperature of about 900°C to about 1000°C (column 2, lines 15-19). It would have been obvious to one skilled in the art to combine the teachings of Ibok with that of Park and Yu because growing the oxide at a high enough dry oxidation would cause the top corners of the trench to become rounded, thereby reducing the stress (Ibok, column 2, lines 14-17).

Regarding claim 13, Park further teaches the method as recited in claim 11, wherein the dry oxidation technique is performed to form the lateral oxide layer with a thickness ranging from about 60 A to about 100 A (abstract), but fails to teach a dry oxidation technique is performed at a temperature of about 900°C to about 1000°C. Ibok

teaches a dry oxidation is performed at a temperature of about 900°C to about 1000°C (column 2, lines 15-19). It would have been obvious to one skilled in the art to combine the teachings of Ibok with that of Park and Yu because growing the oxide at a high enough dry oxidation would cause the top corners of the trench to become rounded, thereby reducing the stress (Ibok, column 2, lines 14-17).

Regarding claim 16, Park and Yu fail to teach the method as recited in claim 9, wherein at the step of forming the trench of which top corners are rounded, the top corners of the trench are rounded in an angle of about 30° to about 60° Ibok at the step the top corners of the trench are rounded in an angle of about 30° to about 60° (column 2, line 15).). It would have been obvious to one skilled in the art to combine the teachings of Ibok with that of Park and Yu because corners with a more oblique corner angle cause less stress (Ibok, column 4, lines 39-41).

Regarding claim 18, Park and Yu fail to teach the method as recited in claim 9, wherein the step of making the top corners of the trench more rounded proceeds by employing an isotropic etching technique. Ibok teaches the step of making the top corners of the trench more rounded proceeds by employing an isotropic etching technique (abstract). It would have been obvious to one skilled in the art to combine the teachings of Ibok with that of Park and Yu because the isotropic etch enables the thermal oxidation to form an oxide liner with rounded edges and reduced stress (Ibok, abstract).

Regarding claim 19, Ibok further teaches the method as recited in claim 18, wherein the top corners of the trench is controlled to have an angle ranging from about 50° to about 80° through the use of the isotropic etching technique (column 4, lines 35-39).

Claims 3 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park, Yu, and Ibok as applied to claims 2 and 16 above, and further in view of Downey et al, US Patent 2003/0092273.

Regarding claim 3, Yu teaches the method as recited in claim 2, wherein the step of performing the etching process includes the steps of performing an etching process by using hydrogen bromide (column 3, lines 11-12), removing a native oxide layer formed after the etching process by using carbon tetrafluoride (CF_4) gas (column 3, lines 11-12), performing an etching process with use of a gas containing hydrogen bromide and chloride gas to form the trench with a predetermined depth (column 3, lines 35-37), but Park, Yu, and Ibok fail to teach performing an etching process by using a gas containing CF_9 and oxygen (O_2) gas to purge the chloride gas from a chamber. Downey teaches performing an etching process by using a gas containing CF_9 and oxygen (O_2) gas to purge the chloride gas from a chamber [0027]. It would be obvious to one skilled in the art to combine the teachings of Downey with that of Park and Yu

because it is well-known that traces of chlorine left behind may result in a catalytic reaction with water left in the process an may result in the creation of ammonium (Downey, [0004]).

Regarding claim 17, Yu further teaches the method as recited in claim 16, wherein the step of forming the trench further includes the steps of performing an etching process by using hydrogen bromide (column 3, lines 11-12), removing a native oxide layer formed after the etching process by using CF_4 gas (column 3, lines 11-12), performing an etching process by using a gas containing hydrogen bromide and chlorine gas until the trench has a predetermined depth (column 3, lines 35-37), but Park, Yu, and Ibok fails to teach performing an etching process by using a gas containing CF_9 and oxygen (O_2) gas to purge the chloride gas from a chamber. Downey teaches performing an etching process by using a gas containing CF_9 and oxygen (O_2) gas to purge the chloride gas from a chamber [0027]. It would be obvious to one skilled in the art to combine the teachings of Downey with that of Park and Yu because it is well-known that traces of chlorine left behind may result in a catalytic reaction with water left in the process an may result in the creation of ammonium (Downey, [0004]).

Claims 6 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Par, Yu, and Ibok as applied to claims 4 and 16 above, and further in view of Huang, US Patent 6,225,187.

Regarding claim 6, Ibok further teaches the method of claim 4, wherein the technique is isotropic etching, but Park, Yu, and Ibok fails to teach the technique uses a gas containing CF_9 and 0_2 gas (column 2, lines 10 and 11). Huang teaches the technique uses a gas containing CF_9 and 0_2 gas (column 2, lines 10 and 11). It would have been obvious to one skilled in the art to combine the teachings of Huang with that of Park,Yu, and Ibok because a dry etchant that can be used for etching is a mixture that consists of $CHF_3/CF_4/O_2/Ar$ (Huang, column 2, line 51).

Regarding claim 20, Ibok further teaches the method of claim 16, wherein the technique is isotropic etching , but Park, Yu, and Ibok fails to teach the technique uses a gas containing CF_9 and 0_2 gas (column 2, lines 10 and 11). Huang teaches the technique uses a gas containing CF_9 and 0_2 gas (column 2, lines 10 and 11). It would have been obvious to one skilled in the art to combine the teachings of Huang with that of Park,Yu, and Ibok because a dry etchant that can be used for etching is a mixture that consists of $CHF_3/CF_4/O_2/Ar$ (Huang, column 2, line 51).

Claims 10, 12, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park and Yu as applied to claim 9 above, and further in view of Jambotkar, US Patent 4,087,832.

Regarding claim 10, Park and Yu fail to teach the method as recited in claim 9, wherein the step of forming the oxide layer includes the steps of forming a screen oxide layer for a threshold voltage control on the substrate, implanting a dopant for a threshold voltage control by using the screen oxide layer as a mask, removing the screen oxide layer, and forming a gate oxide layer on an exposed surface of the substrate after removing the screen oxide layer. Jambotkar teaches the step of forming the oxide layer includes the steps of forming a screen oxide layer for a threshold voltage control on the substrate, implanting a dopant for a threshold voltage control by using the screen oxide layer as a mask, removing the screen oxide layer, and forming a gate oxide layer on an exposed surface of the substrate after removing the screen oxide layer (column 4, lines 1-25). It would have been obvious to one skilled in the art to combine the teachings of Jambotkar with that of Park and Yu because to form a doped region in the substrate (Jambotkar, column 4, line 10), which is commonly known to as a source and drain.

Regarding claim 12, Park further teaches the method as recited in claim 10, wherein the screen oxide layer and the gate oxide layer are formed through a dry oxidation technique. (Note: Jambotkar teaches that the screen oxide layer (referred to as a thermal oxide layer is grown on a substrate. One method to do this is dry thermal oxidation, which is taught by Park. See Park, column 4, lines 59 and column 6, lines 58-60).

Regarding claim 14, Park, Yu, and Jambotkar fail to teach the method as recited in claim 12, wherein the screen oxide layer is formed at a temperature ranging from about 850°C to about 1000°C with a thickness in a range from about 50 A to about 150 A. However, given the teaching of the references, it would have been obvious to determine the optimum thickness, temperature as well as condition of delivery of the layers involved See *In re Aller, Lacey, and Hall* (10 USPQ 23 3-237) "It is not inventive to discover optimum or workable ranges by routine experimentation. Note that the specification contains no disclosure of ether the critical nature of the claimed ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that tile chosen dimensions are critical. *In re Woodruff*, 919 f.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Any differences in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Appellants have the burden of explaining the data in any declaration they proffer as evidence of non-obviousness. *Ex parte Ishizaka*, 24 USPQ2d 1621, 1624 (Bd. Pat. App. & Inter. 1992).

An Affidavit or declaration under 37 CFR 1.132 must compare the claimed subject matter with the closest prior art to be effective to rebut a prima facie case of obviousness. *In re Burckel*, 592 F.2d 1175, 201 USPQ 67 (CCPA 1979).

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Park, Yu, and Jambotkar as applied to claim 12 above, and further in view of Ibok, US Patent 6,180,466.

Regarding claim 15, Park, Yu and Jambotkar fail to teach the method as recited in claim 12, wherein the gate oxide layer is formed at a temperature ranging from about 850^{0}C to about 1000^{0}C. Ibok teaches the gate oxide layer is formed at a temperature ranging from about 850°C to about 1000°C (column 2, lines 14 and 15). It would have been obvious to one skilled in the art to combine the teachings of Ibok with that of Park, Yu, and Jambotkar because growing the oxide at a high enough dry oxidation would cause the top corners of the trench to become rounded, thereby reducing the stress (Ibok, column 2, lines 14-17).

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Quovaunda Jefferson whose telephone number is 571-272-5051. The examiner can normally be reached on Monday through Friday, 8AM to 4:30PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

qvj

MATTHEW SMITH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800